

Large Intestinal Motility

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Intended Learning Objectives (ILOs)

:After studying this, you should be able to

List the **types of motility in the colon** (haustral -1
.contractions and mass movements)

Explain **how motility patterns of the colon** -2
subserve its function to desiccate and evacuate the
.stool

Explain the physiological significances of the -3
.gastroileal and gastrocolic reflexes

Explain **how gastrointestinal motility changes** -4
during fasting (MMC)

.Describe **defecation reflex** and its control -5

Interpret the causes and consequences of **abnormal** -6
intestinal motility (Constipation and Diarrhea)

Movements of the colon: 2 types

1- Haustral contractions (Huastrations)

(Mixing Movement): The outer longitudinal smooth muscle layer of the colon is collected into 3 separate longitudinal strips called taeniae coli, which are shorter than the underlying circular smooth muscle and mucosal layers. Because of this, the underlying layers bulge outward into baglike sacs (or pouches) called haustra. Contraction of the circular smooth muscle actively changes the location of haustra.

Haustrations: are the colon's primary motility. Initiated by the autonomus pace-maker cells in large intestine that produces slow wave potentials. When they reach threshold, action potentials are initiated, followed by haustral contractions. Similar to small intestine segmentations, but are less frequent. The location of the haustral sacs gradually changes as a relaxed segment that has formed a sac slowly contracts while a previously contracted area simultaneously relaxes to form a new sac. Controlled mainly by intrinsic plexuses (local reflexes).

Function of haustrations:

1. Slowly move the colonic contents in a back and forth mixing movement. This exposes the colonic contents to the absorptive mucosa, thus helps absorption.

2. Because they are slow and non-propulsive:

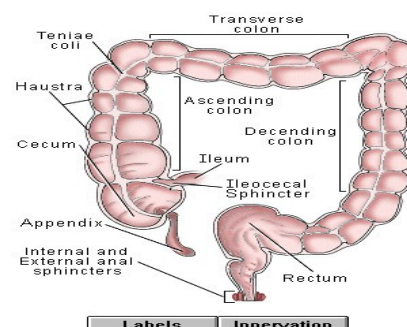
- help storage of feces.

- allow sufficient time for bacteria to grow and accumulate in the large intestine (most colonic micro-organisms are harmless).

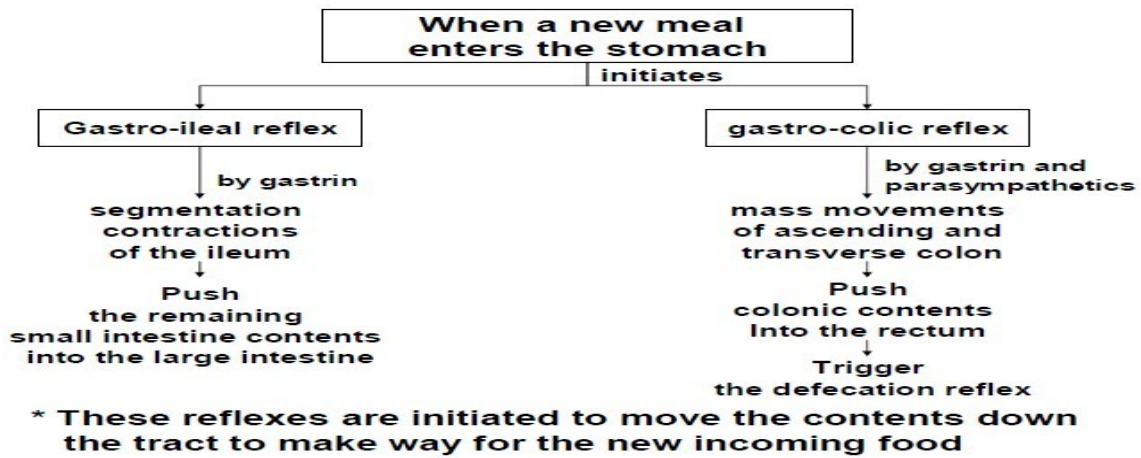
2- Mass movements (Propulsive Movement):

- Occur 3-4 times/day, generally after meals, but, in most people, occur after eating breakfast (1 time/day). Simultaneous, strong contractions of large segments of the ascending and transverse colon, forcing the colonic contents into the distal part of the large intestine, where material is stored until defecation occurs. A whole series of mass movements usually persist for 10-30 minutes. Primarily initiated by gastro-colic reflex.

Gastro-colic reflex:



- initiated by the arrival of new food to the stomach.



- Mediated by:

- * gastrin.
- * parasympathetic nerves.

- in many people, this reflex occurs mostly after the first meal of the day (breakfast).

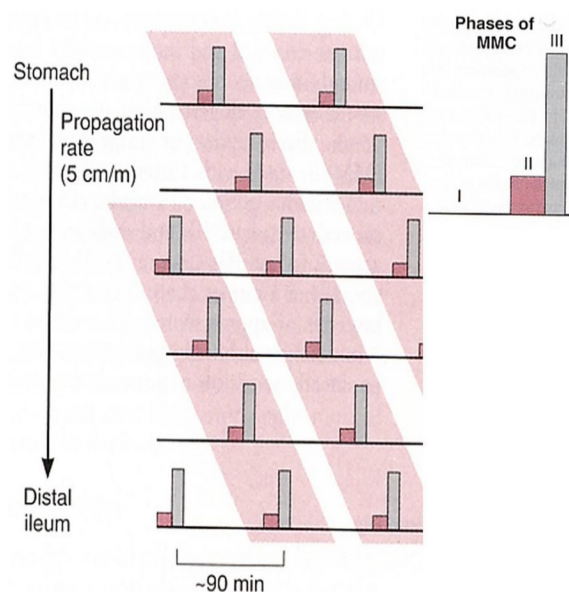
- is often followed by the urge to defecate.

Migrating motility complex (MMC): intestinal house keeper:

(Occurs During Fasting)

- Consists of weak, repetitive peristaltic waves that move a short distance down the intestine. Is regulated by hormone **motilin** which increases intensity of MMC. Starts at the stomach, migrates to the end of small intestine within 1.5 to 2.5 hours.

Function: Clear stomach and small intestine of



luminal contents (remnants of food, mucosal debris and bacteria) to the colon, in preparation for the next meal.

* Between meals (i.e., during fasting between periods of digestion), segmentation contractions are replaced by migrating motility complex. When the next meal arrives: migrating motility complex ceases, and segmentation contraction is triggered again.

Defecation reflex:

When mass movements of the colon move fecal material into the rectum, this results in:

→ distension of the rectum → stimulate **stretch receptors** in the rectal wall → stimulate defecation **center** in the **sacral segment of spinal cord** → via parasympathetic (in **pelvic nerves**) causes: **contraction** of rectum and **relaxation** of internal anal sphincter → **conscious urge to defecate**.

Voluntary control of defecation:

- If the condition is favorable for defecation:

Cerebral cortex causes: voluntary relaxation of the external anal sphincter thus, defecation occurs.

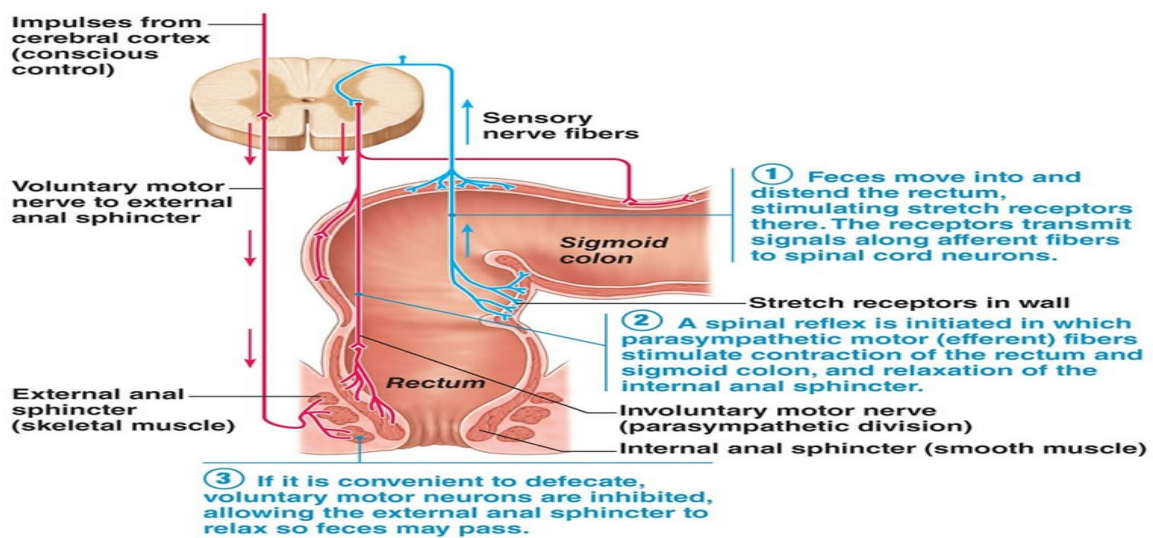
- If the condition is unfavorable for defecation:

Cerebral cortex causes: voluntary contraction of the external anal sphincter that can prevent defecation, despite the defecation reflex.

***When defecation occurs, it is assisted by voluntary straining** movements, as follows: simultaneous, voluntary contraction of the abdominal muscles and a forcible expiration against a closed glottis → increase intra-abdominal pressure that presses on the rectum → help in elimination of the feces.

Constipation

- **Definition:** It is the passage of hard and dry feces with delayed defecation. If defecation is delayed too long: colonic contents are retained for longer period of time than normal → more H₂O is absorbed than usual → feces becomes hard and dry (i.e., constipation). Normal, frequency of defecation: ranges from 3 / day - 1 / week.
- **Symptoms:** Abdominal discomfort, dull headache, loss of appetite sometimes accompanied by nausea, and mental depression. These symptoms are caused by prolonged distension of the large intestine, particularly the rectum, and not caused by toxins absorbed from the retained fecal material.
- **Causes:**
 1. Ignoring the urge to defecate.
 2. Decreased colonic motility accompanying:
 - aging, emotional stress and a low bulk diet (by decreased dietary fibers in diet).
 3. Obstruction of fecal movements in the large intestine caused by colonic spasm or local tumor in the colon.



- #### 4. Impairment of the defecation reflex.

Diarrhea

- **Definition:** It is passage of a highly fluid fecal matter with increased frequency of defecation. The intestine is unable to absorb fluid as extensively as normal. As a result, extra unabsorbed fluid passes out in the feces.
- **Effect of diarrhea:**
 - a. Beneficial effects:** hastens the elimination of harmful materials from the body.
 - b. Harmful effects:** loss of the nutrient materials and the secreted juice: Loss of H_2O causes dehydration and decreased plasma volume → decreased blood pressure and circulatory shock. Loss of HCO_3^- in feces → decreased plasma HCO_3^- and metabolic acidosis. Loss of K^+ in chronic diarrhea causes hypokalemia.
- **Causes:**
 1. Increased small intestinal motility (the most common cause) caused by local irritation by bacterial or viral infection and emotional stress (i.e., psychogenic diarrhea).
 - * Increased intestinal motility causes rapid transit of the intestinal contents that does not allow sufficient time for adequate absorption of fluid in the feces.
 2. Excess osmotically active particles in the lumen of the intestine, **e.g., laxative as magnesium sulphate or deficiency of lactase enzyme.**
 - * **deficiency of lactase enzyme causes:**
 - ® accumulation of undigested lactose in the intestinal lumen (i.e., increased osmotic pressure).
 - ® excessive fluid enters and retains in the intestinal lumen.
 - ® increased fluidity of feces, causing diarrhea.
 3. Toxins of the bacterium *Vibrio cholera* lead to:

® excessive secretion of electrolytes and fluids, from the crypts of Leiberkuhn in the distal ileum and colon.

® increase osmotically active particles in intestinal lumen.

® excessive fluid enters the intestinal lumen.

® increased fluid in feces, resulting in profuse diarrhea.

*****Physiologic basis for therapy in cholera:**

- replace the lost fluid and electrolytes by intravenous saline (Na^+) and glucose, or by oral administration of Na^+ and glucose (oral rehydration therapy), so that the Na^+ is absorbed via the Na^+ -glucose cotransporter.

- use of antibiotics.